International Journal of Agricultural
Science and Research (IJASR)
ISSN (P): 2250-0057; ISSN (E): 2321-0087
Vol. 9, Issue 3, Jun 2019, 259-266

AN EVALUATION OF THIOUREA APPLICATION IN BREAKING DORMANCY OF BLACK NIGHTSHADE (*SOLANUM NIGRUM* L)

S. KEERTHANA[*] & K. SUNDARALINGAM

Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

ABSTRACT

Black nightshade (Solanum nigrum L.) is a medicinal plant which belongs to Solanaceae family and grows widely in the temperate and tropical regions. Seeds of this species possess primary dormancy which restricts germination. The main aim of this study is to break the dormancy present in seeds and to enhance the germination under favourable condition. Hence, various dormancy breaking treatments were imposed on seeds for different durations viz., 6, 12 and 24 hin various solutions viz., water, GA_3, Potassium Nitrate, Thiourea,. Dry seeds served as control. The results revealed that seed treatment with thiourea 1% for 6 h recorded the highest germination (85%) than control (23%). The growth of seeds was accompanied with the vigour attributing characters viz., speed of germination (5.9), root length (2.3 cm), shoot length (3.3 cm), vigour index (487).

KEYWORDS: Black Nightshade (Solanum nigrumL.), physiological Dormancy, Thiourea & Germination

Received: Apr 05, 2019; **Accepted**: Apr 25, 2019; **Published**: May 21, 2019; **Paper Id.**: IJASRJUN201938

Original Article

INTRODUCTION

Solanum nigrum L. commonly known as Black nightshade or Garden nightshade belongs to the family Solanaceae. *Solanum nigrum* L. thrives well in temperate and tropical regions and grows up to 3500 metres altitude. It is a herbaceous plant growing up to the height of 1.25 m tall and widely used as leafy herbs and vegetables, as a source of fruit and medicinal purposes. The stems are rough in texture, leaves are alternate, oval and are carried on short stalks, and flowers are small star-shaped white color which open successively over several days. Fruits are globular, dull green during immature and turned to purplish-black when they ripe. Berries are known as "fragrant tomato" which are 6 to 8 mm in diameter, which contains many flattened, pitted, and yellow to dark brown woody seeds with the size of approximately 1.5 mm long. Seeds of *S. nigrum* L. are small, slightly discoid, pale yellow to brown in colour and with the size of 1.24-1.34 mm (Suthar*et al*., 2009). Fruits and juices of '*S. nigrum* L.' are used to cure stomach ailments, fever, blood impurities and young shoots to cure skin diseases (Jagatheeswari *et al*., 2013).

Majority of medicinal plants are non-domesticated and as they grow as wild plant (Pallavi*et al.*, 2014). For efficient cultivation of this species, the seeds must be viable and non-dormant. Cultivation of non-dormant seeds, allows uniform germination, emergence, and optimal stand for establishment of plants. Fresh seeds of S. *nigrum* L. were temporarily dormant and germinate at higher alternating temperature. Givelberg *et al.*, (1984) proposed that some genotypes of black nightshade may have primary dormancy and the type of seed dormancy present in *S. nigrum* L. is not known. Therefore, in order to study the germination and dormancy pattern of Black nightshade an experiment was conducted.

MATERIALS AND METHODS

Freshly harvested fruits were collected from Pappampatti, Coimbatore, Tamil Nadu and the seeds were extracted by the method suggested by Gunasekaran (2003). The seeds were dried under shade and sun andthe laboratory studies was undertaken at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore. Seeds were cleaned and separated into sinkers and floaters using water. The seeds were air dried and stored under ambient condition. The graded (sinkers) seeds were subjected to the following treatments with the soaking durations of 6,12 and 24 h.

Treatment

- **T_0 -** Control
- **T_1 -** Water
- **T_2** -$GA_3$100ppm
- **T_3**- $GA_3$200ppm
- **T_4 -** $GA_3$500ppm
- **T_5** - $KNO_3$0.5%
- **T_6** - KNO_3 1.0 %
- **T_7** - Thiourea 0.5%
- **T_8**- Thiourea 1.0 %

After soaking, the seeds were dried at room temperature. Germination percent was determined as per ISTA rules for seed testing. The germination was conducted on top of paper (TP) medium. Hundred seeds of four replications were tested at a constant temperature of 25$\pm$ 2°C. The number of normal seedlings were evaluated on 14thday and percent germination was expressed on normal seedling basis (ISTA, 2016). From the standard germination test, ten normal seedlings were selected at random in each replication on final count day. The shoot and root length was measured, sum of root and shoot length measured constitute the seedling length and mean was calculated and expressed in cm. Seedling Vigour index (VI) was calculated using the formula proposed by Abdul-Baki and Anderson (1973) and the mean values were expressed in whole number.

Seedling vigour index = Germination (%) x Mean seedling length (cm)

Seed germination test was conducted as described above and daily germination counts were recorded on the basis of germinated seeds possessing radicle size of 3-5 mm. The speed of germination was calculated by using the formula suggested by Maguire (1962).

Speed of germination = $\frac{X1}{Y1} + \frac{X2 - X1}{Y2} + \ldots\ldots + \frac{Xn - Xn{-}1}{Yn}$

Where, X_1- Number of seeds germinated at first count

- **X_2-** Number of seeds germinated at second count
- **X_n-** Number of seeds germinated on nth day

- **Y_1-** Number of days from sowing to first count
- **Y_2-** Number of days from sowing to second count and
- **Y_n**- Number of days from sowing to n^{th} count

RESULTS AND DISCUSSIONS

Among the treatments, thiourea 1%for 6 h significantly improved the germination than other growth regulators such as GA_3 (100, 200 and 500ppm), KNO_3 (0.5% and 1%) and control (dry seeds). The experiment revealed that concentration of thiourea 1% was highly significant for germination, speed of germination, root length, shoot length, and vigour index (Table 1, 2 &3 and Fig.1). Due to the treatment with thiourea the germination percentage was enhanced which ranged from 76% in 0.5% thiourea to 85% in 1% thiourea when the seeds soaked in 6 h duration. When the soaking duration increase from 6 to 12 and 24 h significantly there was reduction in germination by 1.1 % in 12 h and 3.6 % in 24 h. The increase in duration of thiourea treatment in both concentrations significantly reduced the germination percentage with concomitant changes in seedling quality parameters such as speed of germination, root length, shoot length and vigour index which might be due the interactions between light, temperature, and thiourea concentration affect seed germination (Mayer and Poljakoff-Mayber, 1975) during prolonged period of soaking. Thiourea is the most widely used chemical for promoting germination of seeds which are sensitive to light. Small seeds require light for germination. Effects of thiourea on seed germination was due to alteration in the metabolite concentration in the seeds and seedlings as a result of change in hydrolytic enzymes activity. It seems possible that changes in the nucleic acid metabolism of the seeds (Poljakoff-Mayber*et al.*, 1958). Similar results was reported by Shobharani (2018) by soaking the seeds of henna in 1 % Thiourea solution for 24 himproved the seed germination. The beneficial effects of thiourea used for the seed treatments on promoting seed germination and vigour were also reported by Hartmann *et al*. (1997) in *Prunus* seeds, Arularasu and Sambandamurthi (1999) in *Ocimum sanctum* and Revathi (2001) in *Phylanthusamarus*, Choudhary and Kaul (1973) in *Atropa* belladonna; Pandey *et al.* (2000) in *Aconitumheterophyllum*.

However, in the present study maximum germination percentage was recorded in 1% thiourea for 6 h soaking as compared to other growth regulators there were reduction in germination of 43% in KNO_3 0.5%, 47% in KNO_3 1% and 40% in GA_3 500ppm when compared to control. Hence, optimizing concentration of dormancy breaking treatment and duration is a crucial factor for each and every species. Although other seed treatments also had a positive impact on dormancy release, seeds treated with 1% KNO_3 for 12 h recorded germination of 81% over control seeds (Table 1 and Fig.1). According to Bewley and Black (1983) Postasium Nitrate raises the ambient oxygen level by making less oxygen available in citric acid cycle. It also increases the germination of photo-dormant seeds. Moreover Potassium Nitrate solution has long been known as a suitable chemical approach for promoting germination in various plant species and generally as a priming agent or germination media (McDonald, 2000). Similar results were concluded by Roberts *et al.*(1978) that treating the *Solanum nigrum* seed with 0.2% of KNO_3 improved the germination percentage. The results were supported by Roberts and Smith (1977) and Shanmugavalli*et al.*, (2007) in fodder sorghum. Similarly, seeds treated with gibberllic acid and water soaking treatment also significantly increased germination and the seedling vigour over control and are on par with each other.

Since, thiourea 1% for 6 h increased the germination percentage by breaking the seed dormancy by 72% over control (dry seeds), it was concluded that type of dormancy present in black nightshade (*Solanum nigrum* L.) might be

physiological dormancy.

CONCLUSIONS

The present study indicated that the dormancy in Black nightshade seeds could be overcome successfully by soaking the seeds in 1% thiourea for 6 h. By taking the lead from the study, different combination of treatment may be applied to break the dormancy for maximum germination and better survival percentage.

REFERENCES

1. *Abdul-Baki, A. A. and Anderson, J. D. 1973. Vigor determination in soybean seed by multiple criteria. Crop science, 13(6): 630-633*
2. *Arularasu, P., & Sambandamurthi, S. (1999). Effect of germination nitrogen and spacing on yield of herbage and oil yield in Tulasi (Ocimum sanctum L.). South Indian Horticulture, 47(1/6), 370-372.*
3. *Bewley, J. D. & Black, M. (1982). Physiology and bio-chemistry of seed in relation to germination, viability, dormancy and environmental control, Vol. 2, Springer-Verlag, New York. p. 375.*
4. *Choudhary, D., & Kaul, B. (1974). Note on the effect of thiourea on the germination of Atropabelladonna L. Indian journal of agricultural sciences, 89-91.*
5. *Givelberg, A., Horrowitz, M., & Poljakoff-Mayber, A. (1984). Germination behaviour of Solanum nigrum seeds. Journal of Experimental Botany, 35(4), 588-598.*
6. *Gunasekaran, A. (2003). Seed development and maturation, extraction, methods, germination test and storage.M. Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.*
7. *Hartmann, K., Kroob, C., & Mollwo, A. (1997). Phytochrome-mediated photocontrol of the germination of the Scentless Mayweed, Matricaria inodora L., and its sensitization by nitrate and temperature. Journal of Photochemistry and Photobiology B: Biology, 40(3), 240-252.*
8. *Aruna, S. D., & Srinath, R. (2014). Effect of Gamma Radiation on Germination and Physiological Aspects of Pigeon Pea (Cajanus Cajan (L.) Millsp). Seedlings.*
9. *Jagatheeswari, D., Bharathi, T., & Sheik Jahabar Ali, H. (2013). Black Night Shade (Solanum nigrum L.) - An Updated Overview. International Journal of Pharmaceutical & Biological Archives 2013, 4(2), 288 – 295.*
10. *Maguire, J. D. 1962. Speed of Germination - Aid in selection and evaluation for seedling emergence and vigour. Crop science, 2(2):176-177.*
11. *Mayer, A.M., and A. Poljakoff-Mayber. 1975. The germination of seeds, 2nd ed. Pergamon Press, New York. Pp.192.*
12. *Preetha, E., & Saravanakumari, P. Evaluation Of The Phytotoxicity Of Cotton Microdust Compost Based On Seed Germination And Seedling Growth.*
13. *McDonald, M. B. (2000). Seed priming, In: Black, M. & J.D. Bewley (eds.). Seed technology and its biological basis. Sheffield Academic Press Ltd., Sheffield, UK. p. 287–325*
14. *Pallavi, H., Vishwanath, K., Harish, B., Prashanth, Y., & Thattimani, M. (2014). Seed treatments to break seed dormancy and Standardization of viability test procedure in Abrus precatorious. Journal of Medicinal Plants Research, 8(4), 229-236.*
15. *Pandey, H., Nandi, S., Nadeem, M., & Palni, L. (2000). Chemical stimulation of seed germination in Aconitum heterophyllum Wall. and A. balfourii Stapf.: important Himalayan species of medicinal value. Seed science and technology, 28(1), 39-48.*

16. *Singh, D., & Sharma, N. (2017). Effect of chromium on seed germination and seedling growth of green garm (Phaseols Aureus L) and chickpea (Cicer Arietinum L). Int J App Nat Sci, 6, 37-46.*

17. *Poljakoff-Mayber, A., & Mayer, A. M. (1960). Effect of thiourea on germination and growth. lndian Journal of Plant Physiology, 3, 125-138.*

18. *Revathi, R. (2001). Seed production, testing and storage studies in Phyllanthus amarus (Schum and Thom.). M. Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.*

19. *Robert, S. E. & Smith, R. D. 1977. Dormancy and the pentose phosphate pathway. In: KHAN A. (ed.), The Physiology and Biochemistry of Seed Dormancy and Germination. Amsterdam, NorthHolland Publishing Co. pp. 385-411.*

20. *Roberts, H., & Lockett, P. M. (1978). Seed dormancy and field emergence in Solanum nigrum L. Weed Research, 18(4), 231-241.*

21. *Shanmugavalli, M., Renganayaki, P. R., & Menaka, C. (2007) Seed dormancy and germination improvement treatments in fodder sorghum. Journal of SAT Agricultural Research, 3 (1), 1-3.*

22. *Shobharani. M. (2018). Standardization of seed germination testing procedures and seed germination improvement in medicinal plants.M. Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.*

23. *Suthar, A. C., Naik, V. R., & Mulani, R. M. (2009). Seed and seed germination in Solanum nigrum Linn. American-Eurasian Journal of Agriculture and Environmental Science, 5(2), 179-183.*

APPENDIX

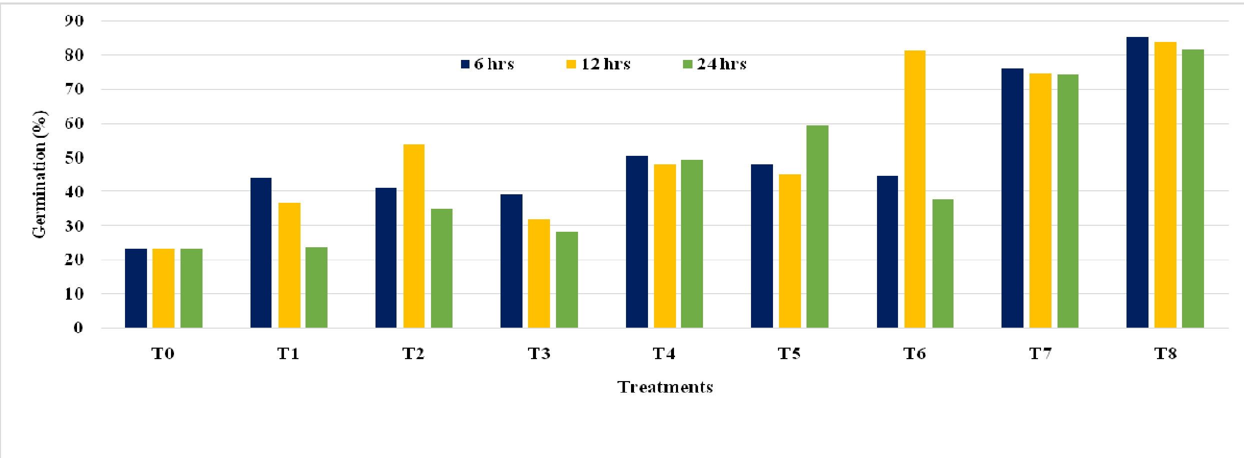

Figure 1: Influence of Different Dormancy Breaking Seed Treatments on Germination (%) in Black Night Shade

Table 1: Influence of Different Dormancy Breaking Seed Treatments on Germination (%) and Speed of Germination in Black Night Shade

	Germination (%)				Speed of Germination			
Treatments(T)/ Duration (D)	**6 h**	**12 h**	**24 h**	**Mean**	**6 h**	**12 h**	**24 h**	**Mean**
T_0- Control	23 (28.66)	23 (28.66)	23 (28.66)	**23 (28.66)**	2.0	2.0	2.0	**2.0**
T_1 - Water soaking	44 (41.55)	37 (37.46)	24 (29.33)	**35 (36.27)**	2.8	2.5	2.1	**2.4**
T_2 - GA_3 100 ppm	41 (39.82)	54 (47.29)	35 (36.27)	**43(40.98)**	2.5	4.1	2.5	**3.0**
T_3 - GA_3 200 ppm	39 (38.65)	32 (34.45)	28 (31.95)	**33 (35.06)**	2.6	2.4	2.3	**2.4**
T_4 - GA_3 500 ppm	51 (45.57)	48 (43.85)	49 (44.43)	**49 (44.43)**	3.3	3.2	3.2	**3.2**
T_5 - KNO_3 0.5%	48 (43.85)	45 (42.13)	59 (50.18)	**51 (45.57)**	2.8	2.7	3.5	**3.0**
T_6 - KNO_3 1%	45 (42.13)	81 (64.16)	38 (38.06)	**55 (47.87)**	2.7	5.5	2.3	**3.5**
T_7 - Thiourea 0.5%	76 (60.67)	75 (60.00)	74 (59.34)	**75 (60.00)**	5.1	5.0	5.1	**5.0**
T_8 - Thiourea 1%	85 (67.21)	84 (66.42)	82 (64.90)	**83 (65.65)**	5.9	5.7	5.6	**5.7**
Mean	**50 (45.00)**	**53 (46.72)**	**46(**42.71)		**3.3**	**3.6**	**3.1**	

	T	D	T x D		T	D	T x D
SEd	2.514	1.451	4.354	**SEd**	0.289	0.166	0.500
CD(P=0.05)	5.040	2.910	8.730	**CD(P=0.05)**	0.579	0.334	1.004

(Figures in parentheses indicate arc sine transformed values)

Table 2: Influence of Different Dormancy Breaking Seed Treatments on Root Length (cm) and Shoot Length (cm) in Black Night Shade

	Root Length (cm)				Shoot Length (cm)			
Treatments(T)/ Duration (D)	**6 h**	**12 h**	**24 h**	**Mean**	**6 h**	**12 h**	**24 h**	**Mean**
T_0–Control	1.7	1.7	1.7	**1.7**	2.3	2.3	2.3	**2.3**
T_1 - Water soaking	1.9	1.8	1.7	**1.8**	2.7	2.6	2.4	**2.5**
T_2 - GA_3 100 ppm	1.8	2.1	1.8	**1.9**	2.6	2.9	2.6	**2.7**
T_3 - GA_3 200 ppm	1.7	1.9	1.7	**1.8**	2.5	2.6	2.5	**2.5**
T_4 - GA_3 500 ppm	2.0	2.1	1.9	**2.0**	2.9	2.6	2.7	**2.7**
T_5 - KNO_3 0.5%	1.8	1.7	2.0	**1.8**	2.7	2.6	2.8	**2.7**
T_6 - KNO_3 1%	1.9	2.2	1.8	**2.0**	2.7	3.1	2.6	**2.8**
T_7 - Thiourea 0.5%	2.1	2.1	2.1	**2.1**	3.1	3.0	2.9	**3.0**
T_8 - Thiourea 1%	2.3	2.3	2.2	**2.3**	3.3	3.2	3.0	**3.1**
Mean	**1.9**	**2.0**	**1.8**		**2.7**	**2.8**	**2.6**	

	T	D	T x D		T	D	T x D
SEd	0.056	0.032	0.097	**SEd**	0.079	0.045	0.137
CD(P=0.05)	0.113	0.065	0.195	**CD(P=0.05)**	0.159	0.091	0.275

Table 3: Influence of Different Dormancy Breaking Seed Treatments on Vigour Index and Fresh Ungerminated (%) in Black Night Shade

Vigour Index					**Fresh Ungerminated (%)**			
Treatments(T)/ Duration (D)	**6 h**	**12 h**	**24 h**	**Mean**	**6 h**	**12 h**	**24 h**	**Mean**
T_0 - Control	94	94	94	**94**	69 (56.17)	69 (56.17)	69 (56.17)	**69 (56.17)**
T_1 - Water soaking	200	160	101	**153**	53 (46.72)	61 (51.35)	64 (53.13)	**59 (50.18)**
T_2 - GA_3 100 ppm	184	258	156	**199**	58 (49.60)	45 (42.13)	58 (49.60)	**53 (46.72)**
T_3 - GA_3 200 ppm	168	140	105	**138**	60 (50.77)	62 (55.55)	64 (53.13)	**62 (51.94)**
T_4 - GA_3 500 ppm	239	223	240	**234**	49 (44.43)	52 (46.15)	51 (45.57)	**50 (45.00)**
T_5 - KNO_3 0.5%	217	195	309	**240**	52 (46.15)	55 (47.87)	41(39.82)	**49 (44.43)**
T_6 - KNO_3 1%	199	426	165	**263**	55 (47.87)	19 (25.84)	62 (51.94)	**45 (42.13)**
T_7 - Thiourea 0.5%	391	365	362	**374**	24 (29.33)	25 (30.00)	26 (30.66)	**25 (30.00)**
T_8 - Thiourea 1%	487	460	421	**456**	15 (22.78)	16 (23.57)	17 (24.35)	**16 (23.58)**
Mean	**242**	**258**	**217**		48 (43.85)	46 (42.71)	**50** (45.00)	

	T	**D**	**T x D**		**T**	**D**	**T x D**
SEd	19.860	11.466	34.400	**SEd**	2.466	1.424	4.272
CD(P=0.05)	39.818	22.989	68.968	**CD(P=0.05)**	4.945	2.855	8.566

(Figures in parentheses indicate arc sine transformed values)